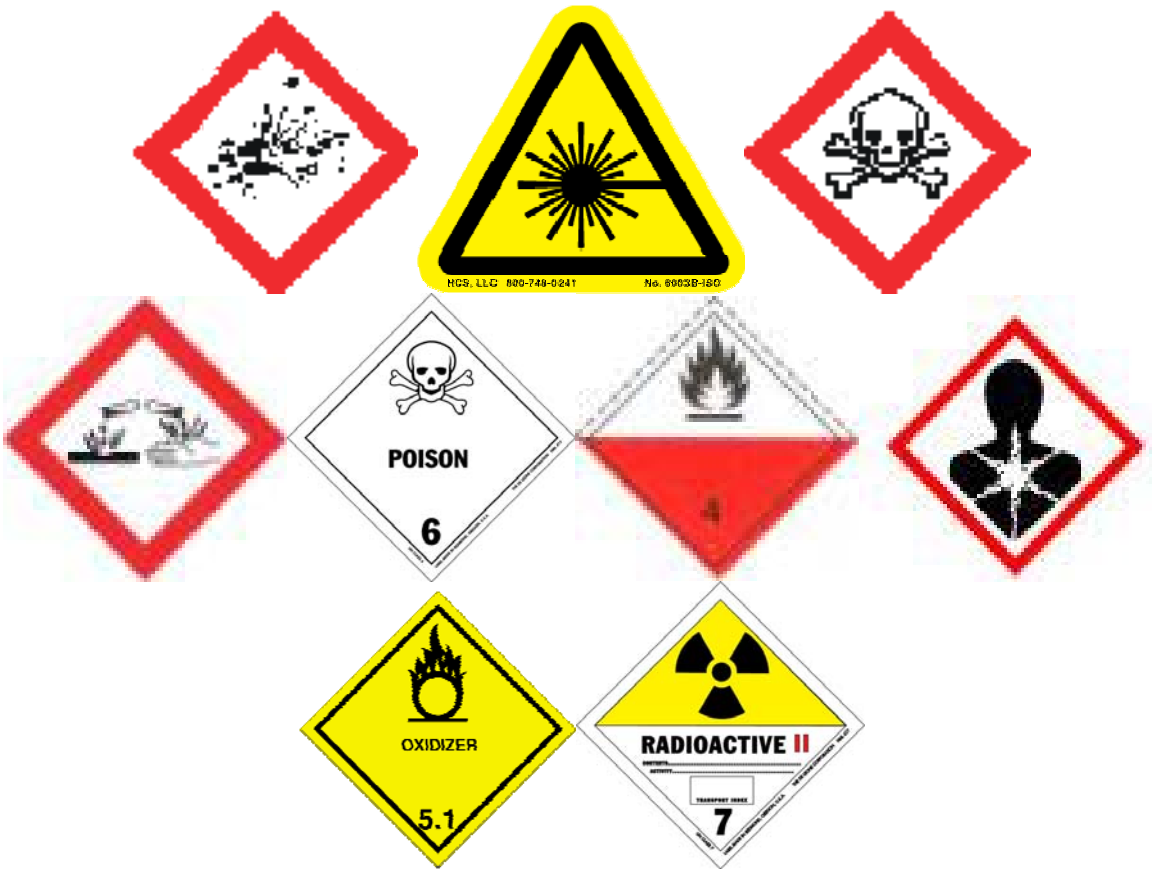
Miami-Dade County Public Schools

Chemical Hygiene & Laboratory Safety Plan (CHLSP)*



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CHEMICAL HYGIENE & LABORATORY SAFETY PLAN

OVERVIEW

The following Chemical Hygiene & Laboratory Safety Plan (CHLSP) was developed to outline protocols to safeguard school staff and students working in school biological and chemical laboratories. This CHLSP complies with the Occupation Safety & Health Administration's (OSHA), Title 29 Code of Federal Regulations (CFR), Part 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories." (http://www.OSHA.gov) The OSHA laboratory rules apply to all who engage in the laboratory use of hazardous chemicals. The purpose of the rules is to assure that all laboratory worker exposure to hazardous chemicals is below certain Permissible Exposure Limits (PELs) for substances specified in 29 CFR Part 1910, Subpart Z.

The information in this guidance document is intended to assist school personnel in creating a science safe school environment where chemicals are purchased wisely, stored safely, handled by trained staff and disposed of properly.

To build students knowledge of the physical and chemical characteristics of the world, most if not all, high school and middle school science laboratories use dozens of potentially hazardous chemicals while conducting hands-on laboratory experiments. Unfortunately, hands-on laboratory work with hazardous chemicals can put students and school staff at risk to exposure, accidents and injuries; if the chemicals are mishandled, inappropriately used or have degraded due to age. Consequently, MDCPS recognizes the need for a CHLSP to implement work procedures and safety practices that protect students and staff from the health hazards associated with handling hazardous chemicals in order to create a safe laboratory environment.

Anyone handling or working near hazardous chemicals in MDCPS middle and high schools science laboratories are required to follow the rules and recommendations outlined in this document This document specifies work practices, standard operating procedures, control methods, use of personal protective equipment and any special precautions necessary while working with hazardous substances in a school laboratory setting. This document is intended to strengthen teachers' knowledge of safety concerns so that they can model safety practices for their students to emulate.

GENERAL PRINCIPLES FOR WORK WITH LABORATORY CHEMICALS

The information contained in this document has been taken from OSHA 1910.1450 Appendix A (http://www.OSHA.gov) which covers the National Research Council's (NRC) recommendations concerning chemical hygiene in laboratories. Appendix A is a non-mandatory guidance intended to assist in the development of a written Chemical Hygiene Plan, and was developed from a 1981 NRC publication called "Prudent Practices for Handling Hazardous." The update version of this publication is "Prudent Practices in the Laboratory; Handling and Disposal of Chemicals." A free copy of this book can be found at http://www.nap.edu/catalog/4911.html.

The primary goal of the CHLSP is to reduce, control or eliminate health hazards associated with hazardous chemicals in school laboratories. The recommended general principles or objectives to ensure worker protection from laboratory chemicals are to:

1. Minimize all chemical exposures through prescribed "general" precautions for laboratory chemicals rather than outlining specific guidelines for particular chemicals, while eye and skin contact should be avoided at all cost;
2. Avoid underestimation of risk through the assumption that all substances of unknown toxicity are toxic;
3. Provide adequate ventilation by use of fume hood and other precautionary devices;
4. Institute a chemical hygiene program as a regular and continuing effort; and
5. Observe OSHA's Permissible Exposure Limits (PEL's) and Threshold Limit Values (TLV's) as outlined by the American Conference of Governmental Industrial Hygienists (http://www.**acgih.org)**

Over and above the OSHA requirements, the state requires that designated laboratory staff:

1. Classify and store chemicals in a compatible manner
2. Properly label and disposal of hazardous materials/wastes
3. Inventory chemicals annually
4. Provide and maintain adequate up-to-date safety equipment; and
5. Respond in a timely responsible manner to reported safety concerns.

Chemical Hygiene/Safety Plan Definitions

Chemical Hygiene/Safety Plan means a written program developed by the school experts to sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting students and staff from health hazards presented by hazardous chemicals used in school laboratories.

Emergency means any occurrence, such as, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the laboratory.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas and heat when subjected to sudden shock, pressure or high temperature.

Hazardous Chemical means a chemical that exhibits acute or chronic health affects.

Laboratory means a facility where the "laboratory use of potentially hazardous chemicals" occurs, which typically entails the use of small quantities of potentially hazardous chemicals in an area where scientific experimentation is being conducted.

Laboratory Scale means working with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

Fume Hood means a laboratory device enclosed with a front moveable sash (window) made out of safety glass; constructed and maintained to draw air from the laboratory; to prevent or minimize the escape of air contaminants into the laboratory; and to allow chemical manipulation to be conducted in the enclosure without insertion of any portion of the laboratory worker's body other than arms and hands.

Laboratory Use of Hazardous Chemicals means handling or use of chemicals in which all of the following conditions are met:

1) "Laboratory Scale" chemical manipulations
2) Multiple chemical procedures or chemicals used; and
3) Protective laboratory practices and equipment are available and in common use to minimize the potential for student/teacher exposure to hazardous chemicals.

Physical Hazard means a hazard that is a combustible liquid, compressed gas, explosive, flammable liquid or solid, organic peroxide, oxidizer, pyrophoric material (spontaneous ignition in air), and unstable (reactive) or water reactive material.

Permissible Exposure Limits (PELs) OSHA-PELs tells you how much of an air contaminant, under 29 CFR Part 1910, Subpart Z, a worker can be exposed to for 8 hours per day, 40 hours per week over a 30 year period without suffering adverse health effects. PELs are recommended standards that merely serve as a warning, because most chemicals are not tested for long-term health hazards, reproductive effects and the potential to cause cancer to humans. The OSHA 29 CFR 1910, Subpart Z substances are found at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10147

Unstable (or reactive) means a chemical in the pure state that will vigorously polymerize, decompose, condense or become self-reactive under conditions of shock, pressure or temperature.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or a health hazard.

Threshold Limit Values (TLV's) are American Conference of Governmental Industrial Hygienist (ACGIH)(http://www.acgih.org) exposure standards that are expressed in 3 ways: 1) TLV-TWA is the Time-Weighted Average concentration for a normal 8-hour workday or 40 hour work week; 2) TVL-STL is the Short-Term Exposure Limit or maximum concentration for 15-minute exposure with 4-periods in a workday with 60 minutes between exposures, never to exceed TVL-TWA; and 3) TVL-C is the Ceiling Limit or the amount that should never be exceeded. TVLs are the same as PELs in the respects that they are recommended standards that merely serve as a warning, because most chemicals are not tested for long-term health hazards, reproductive effects and the potential to cause cancer to humans.

RESPONSIBILITIES OF SCHOOL PERSONNEL

The MDCPS Division of Safety and Emergency Management (DSEM) is the delegated administrator of the chemical hygiene program and is responsible to work with Principals/School Site Managers, the designated school site Safety Officer and Science Teachers with regards to chemical hygiene in school laboratories. This department is also responsible to implement the appropriate chemical hygiene policies and practices in order to monitor purchases, use and disposal of chemicals used in the laboratory as well has the authority to conduct all formal laboratory audits.

In an effort to implement a good safety program at each school, it is recommended that a Chemical Hygiene/Safety Officer is designated at each school. In many secondary schools, the Science Department Chairperson or lab coordinator carries these responsibilities. The Chemical Hygiene/Safety Officer is directly responsible for all chemical hygiene concerns in school science laboratories.

Role of the designated Chemical Hygiene/Safety Officer:

- Ensure students and staff know and follow the MDCPS CHLSP
- Verify all chemical stockrooms/storerooms are adequate and well ventilated
- Assure the appropriate protective equipments is available and in working order
- Determine the required levels of protective apparel and equipment
- Conduct routine housekeeping inspections with an emergency equipment checklist
- Maintain documents/records of all routine inspections and condition of the emergency equipment
- Document in writing all identified facility or equipment problems to Principal promptly
- Provide access to reference material to include all Material Safety Data Sheets (MSDSs)
- Ensure that an annual inventory of laboratory chemicals is completed or updated

- Train teachers and students in the proper use of all assigned emergency safety devices and equipment to include: eyewashes, emergency showers, fire extinguishers, spill kits, first aide kits, emergency shutoffs, etc.
- Review the curriculum experiments for adequacy and appropriateness
- Train all Science Teachers prior to the introduction of new chemicals, new procedures, new experiments, substantially modified procedures and experiments, or unique new equipment(s); and
- Provide First Aid, CPR and "hands-on" fire extinguisher training to Science Teachers.

The Science Teacher, if not the Chemical Hygiene/Safety Officer is responsible for laboratory oversight to:

- Plan and conduct activities according to the CHLSP
- Ensure students are knowledgeable with the CHLSP policies and practices
- Impose use of the appropriate protective apparel and equipment in the laboratory
- Ensure scale of work is suitable to the physical facilities available; and
- Report all facility and equipment problems immediately to the Principal.

Appendix A, found in the back of this document, is a Laboratory Safety Contract that is required to be signed by both student and parents, and is to be returned to the Science Teacher before any laboratory experiments are conducted. As part of this contractual agreement, the student consents to wear proper attire during laboratory work. At the time the contract is passed out, is when the Science Teacher should fully explain the consequences and penalties of noncompliance with the safety practices. Henceforth, continuous reinforce and review of safety policies and practices should be conducted. Science Teachers are responsible to keep all students' tests, contracts, and other information pertaining to safety education on file in the science classroom.

Lastly, it is the Science Teacher's responsible to hold the students accountable for following the proper safety procedures while handling laboratory chemicals in the classroom setting. To achieve this goal, the following objectives are recommended to assure student safety:

- Adopt safety training strategies for students as a learning tool
- Host student roundtable discussions to identify potential hazards
- Include students in the planning of safety concerns and consequences
- Maintain a copy of Appendix A, Laboratory Safety Contract signed by student and parents
- Post a copy of Appendix A, Laboratory Safety Contract near telephone, doorways, fume hoods, sinks or other strategic area in the laboratory

- Role-play various safety practices for particular curriculum experiments
- Test students levels of understanding of safety practices and reteach, if needed
- Student-created location diagrams of safety equipment and emergency telephone numbers
- Demonstrate proper use of all the safety/emergency equipment in each laboratory; and
- Impose punishment for safety policy violations.

LABORATORY FACILITIES

This CHLSP is not intended to address laboratory design but will give special attention to emergency alarms and communication systems; safety/shower/eye wash equipment; and laboratory ventilation and fume hood performance..

Emergency Communication Systems

Due to the potential for chemical accidents or releases that can affect other areas of the school, emergency response fire alarms and/or some sort of method to communicate with Main Office should be available. Local fire department telephone number and any access number to the outside should be posted near the laboratory telephone (that is able to reach an outside line), fume hoods, chemical storage doorways, exits, safety showers and fire extinguishers.

Shower & Eye Wash Equipment

The OSHA rules regarding emergency equipment does not adequately define what is considered "suitable facilities" for drenching eyes and body. Therefore, the American National Standards Institute (ANSI) promulgated the ANSI Z358.1-2004 provision (www.**ansi.org)** to outline the installation; performance; use; and maintenance for emergency eye wash and shower equipment. Science Teachers should instruct all students in the location and proper use of safety showers, eye washes, eye/face washes, eye washes/drench hose and drench hose units.

A safety shower should be located within a 100 feet or 10 seconds walking distance from any location within the room. The shower area must be clearly labeled and kept clear of any obstructions. A large ring on a chain when pulled should readily open the valve of the shower allowing 20 gallon of potable lukewarm water per minute for 15 minutes. Eye washes require a controlled 0.4 gallons of water per minute for 15 minutes to rinse both eyes without injuring the user. Eyes/face washes require a controlled 3.0 gallons of water per minute for 15 minutes to rinse both eyes/face without injuring the user.

The ANSI standards allow drench hose units to supplement eye washes with a 3 gallon per minute water flow, but these units may not be used in place of a dedicated eye wash unit. ANSI standards also require all of the above emergency equipment to be activated weekly to ensure they are in proper working order. These weekly tests are required to be documented on an affixed tag attached to the plumbing system. In

accordance with OSHA, maintenance of eye wash units should be inspected quarterly for problems, while other safety equipment should be inspected every 3 to 6 months.

Laboratory Ventilation & Hoods

As with any laboratory safety equipment, the Science Teacher is required to instruct the students in their location and proper usage. The design of the laboratory should facilitate general ventilation for air intake and exhaust to avoid intake of contaminated air and the recirculation of air exhausted from laboratory hoods. However, the ventilation system should not be relied upon for protection from toxic substances released into the laboratory. As well, all stockrooms and chemical storage areas are required to be well ventilated.

Maintenance of all ventilation or related equipment should undergo continuous evaluation and/or modification, if considered inadequate. The ventilation rate should be monitored at least every 3 months and reevaluated whenever any changes/modification has been made to the unit. Substances released into the air of the laboratory should be continually replaced to prevent the increase of hazardous contaminants. Direct air flow into the laboratory should be from non-laboratory areas to an exhaust system leading directly to the outside of the building. General air flow should not be turbulent but relatively uniform throughout the laboratory with no high velocity or static areas.

The National Fire Protection Association rules (www.**nfpa.org**), NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals" apply to laboratory air supply systems for the identification, inspection and maintenance of laboratory ventilation systems and hood(s). The NFPA 45 rules require the following inspection/tests: visual inspection of the physical condition of the ventilation system and hood interior, sash and ductwork; measurement of hood airflow (test and balance); face velocity test verification of inward airflow over the entire hood face; and changes in work area conditions that could affect hood performance or overall laboratory ventilation. The quality and quantity of ventilation should be evaluated upon installation, regularly monitored annually and re-evaluated when the ventilation system is modified.

According to OSHA, a laboratory hood should allow 2.5 linear feet of hood space per person and should be accommodate 2 workers at a time who are working with hazardous chemicals. Work conducted under the hood should be at least 6 inches from the front edge of the hood. Rule to thumb, the suggested ventilation rate of 4-12 room air changes per hour is considered adequate general ventilation. When not working under the fume hood, the hood sash should be kept closed at all times. Keep materials stored under the hood to a minimum and do not allow them to block vents or air flow. Leave hood "on" when it is not in active use if toxic substances are stored under the hood.

Velocity of the hood face should be between 60 to 100 linear feet per minute; however this face velocity should never be relied upon as an indicator for laboratory hood performance. OSHA suggests to use a fume hood when working with any volatile substance with a TLV of less than 50 parts per million. This information can be found

on the Material Safety Data Sheets. The American Chemical Society's suggested reference is Saunders' "Laboratory Fume Hoods: A User's Manual." However, ANSI Z9.5, "Laboratory Ventilation" rules (http://www.aiha.org/Content/InsideAIHA/Standards/z9.htm) also provide further useful information.

MDCPS laboratory equipment policy:

Emergency Exhaust System is required in every science room with a manual switch to turn on the emergency exhaust system that is clearly labeled with a permanent sign.

Goggle Sanitizing Cabinet is required by the State of Florida for students whom are required to use personal eye protection (ch. 1006.063 f.s) in accordance with the American National Standard Institute (ANSI) Z87.1-1979 standards for use, durability, and cleaning. Science Teachers and students must wear goggles in the laboratory at all times with the exception of pre-lab discussion. Appropriate chemical resistant goggles can be purchased through your school's science supply budget. Contact lenses should not be worn in the laboratory. If wearing contacts is unavoidable, the use of non-vented chemical splash goggles is required. Goggles must be sanitized between uses by a goggle sanitizing cabinet. Below is the State of Florida Statute requiring the use of eye-protective devices:

Chapter 1006.063 of the Florida Statute

(1) eye-protective devices shall be worn by students, teachers, and visitors in courses including, but not limited to, chemistry, physics, or chemical-physical laboratories, at any time at which the individual is engaged in or observing an activity or the use of hazardous substances likely to cause injury to the eyes. Activity or the use of hazardous substances likely to cause injury to the eye includes:

(a) Heat treatment; tempering or kiln firing of any metal or other materials;

(b) Working with caustic or explosive materials; or

(c) Working with hot liquids or solids, including chemicals which are flammable, caustic, toxic, or irritating.

(2) District school boards shall furnish plano safety glasses or devices for students, may provide such glasses to teachers, and shall furnish such equipment for all visitors to such classrooms or laboratories, or may purchase such plano safety glasses or devices in large quantities and sell them at cost to students and teachers, but shall not purchase, furnish, or dispense prescription glasses or lenses.

Eye Wash & Shower Stations are required to be located by signs posted in the lab identifying the unit. Eye wash and shower stations are required for every science room, laboratory or shop where students handle materials or chemicals that are potentially dangerous to human tissue. All students should be instructed in the use of the eye wash and shower stations. All safety equipment should not be blocked by debris, be in

proper working condition and clearly labeled with instructions for use. Electrical outlets within six (6) feet of any water supply must be Ground Fault Circuit Interrupter (GFCI).

Fire Blanket is to be mounted on a wall or placed in a cabinet no more than five (5) feet from the floor, be visible and readily accessible. If placed in a cabinet, the cabinet must be clearly labeled "Fire Blanket."

Fire Extinguisher policy requires, at minimum, 2-ABC fire extinguishers mounted no more than five (5) feet from the floor, visible and readily accessible near exit doors. The extinguisher cannot be more than 50 feet from any laboratory stations and cannot be blocked by storage or furniture. The Science Teacher should inspect the condition of the fire extinguishers at least weekly and notify maintenance or the head custodian if the extinguisher appears to be leaking, damaged, or discharged. Extinguishers should be recertified annually or in accordance with the type of fire extinguisher. Provide proper instruction on the use of a fire extinguisher to the class prior to the first laboratory exercise at the beginning of each school year.

First Aid Kits should be purchased by each school and be made available in the laboratories with their location clearly marked. The instructor should take inventory of the kit on a regular basis. The instructor and students should be aware of the proper use of the contents of the first-aid kit.

Fume Hood is used to prevent exposure to toxic, irritating, or noxious chemical vapors and gases as a source of positive ventilation and shut down when the emergency fan is turned on. It must be kept clean and contain minimal storage.

Shut off Switches for gas and electrical shut off are required to be clearly labeled and located in a non-lockable place accessible within 15 feet of the instructor's station to allow cut off of services. Valves must shut completely with one quarter (1/4) turn.

COMPONENTS OF THE CHEMICAL HYGIENE PLAN

According to OSHA, a Chemical Hygiene Plan (CHP) is written to: protect laboratory workers from health hazards associated with hazardous chemicals, keep exposures below specified limits and to have the CHP readily available for review upon request. OSHA believes that controlling a hazard at its source is the best way to protect a worker. In accordance with OSHA, the CHP shall include the following elements:

- Standard Operating Procedures relevant to safety and health concerns that are to be followed when laboratory work involves the use of hazardous chemicals
- Criteria necessary to implement control measures to reduce exposure to hazardous chemicals which is to include the use of personal protective equipment with particular attention to the selection of control measures for extremely hazardous chemicals
- Properly functioning fume hoods and other protective equipment

- Provide laboratory worker training
- Specific laboratory procedures that require prior approval; and
- Designation of a Chemical Hygiene Officer.

Chemical Procurement, Distribution & Storage

Before a substance is ordered and received, information on proper handling, storage and disposal should be known. Preferable all substance should be received in a central location. If a chemical is received without a manufacturer's label--do not accept it! No container should be accepted without an adequate identification label. No container is to be accepted without a label exhibiting the:

- Identity of the hazardous chemical
- Appropriate hazard warnings; and
- Manufacturer's name and address.

By law, it is the manufacturer's responsibility to label containers appropriately. Make this information available to all staff involved in shipping, receiving, storage and distribution.

MDCPS acquisition policy requires that chemicals for lab work or demonstrations be ordered through the school. Acquiring chemicals through other means, including self-purchase by instructors or donations is strictly prohibited unless specifically approved by the Principal. Highly toxic chemicals of any nature are prohibited from use in schools.

Purchase the minimum amount of chemicals necessary for short-term use and distribution. If possible, purchase chemicals in class-size quantities only. Plan for the use of no more than one or two year's worth of chemicals. Do not stockpile chemicals, it is expensive and can be hazardous. Preferably, all hazardous chemicals should be received in a central location within the department and inspected before you sign the bill of lading.

The following guidelines must be followed when receiving and/or handling chemicals:

- Never open a reagent package until the label has been read and completely understood
- Mark all incoming chemicals with the date received and initials of person receiving the chemicals
- Clearly label all chemical storage areas with labels or placards on front of access doors to warn occupants and emergency response personnel such as fire fighters or paramedics
- Properly store flammable liquids in small quantities in containers; and
- Add the newly accepted chemical to the existing chemical inventory list.

Personal Protective Equipment (PPE)

PPE is defined as the use of specialized clothing and equipment designed to be worn by laboratory workers to protect them from direct exposure from health and safety hazards. Examples of these accessories are: safety goggles, face shields, hard hats, hearing protection, gloves, respirators, lab aprons/coats and proper footwear. Always avoid skin contact by using gloves and log sleeves. Wash hands and arms after working with hazardous chemicals.

Engineering controls are designed to eliminate or reduce exposure to a physical or chemical hazard through the use of machinery or equipment such as of fume hoods, respirators and adequate building ventilation. Administrative controls are changes in work policies and procedures to reduce duration, frequency and intensity of exposure to hazardous chemicals or hazardous conditions. A "Chemical Hygiene Plan" is considered an administrative control as well as best management practices, preventative maintenance policies, and routine inspections.

The preferred methods for reducing exposure in the laboratory, in order of general effectiveness are:

1. Substitution of less toxic or hazardous materials/chemicals
2. Engineering Controls
3. Administrative Controls; and/or
4. Personal Protective Equipment (PPE).

The recommended PPE for a particular chemical is found on its respective MSDS. Keep in mind that PPE protects you from a hazard but does not remove the hazard from the work area.

General PPE requirements are found in OSHA's 29 CFR 1019.132 rules (http://www.osha.gov), which require a written hazard assessment in order to select the appropriate PPE for the particular laboratory activity. A written record to indicate each worker has been properly trained in PPE safety and equipment usage is required. The rules 29 CFR 1910.133, .134 138, and 1000 cover the OSHA requirements for Eye & Face; Respiratory; Hand Protection and Air Contaminants, respectively.

PPE should not be used as a substitute for engineering controls or work practices mandated through administrative controls to prevent exposure. As mentioned before, the above rules require the consideration of engineering and administrative controls, where possible, to achieve compliance, before selection and usage of proper PPE.

Housekeeping, Storage, Maintenance & Inspections

Laboratory floors should be cleaned regularly. Formal housekeeping and chemical hygiene inspections should be held at least semiannually. Access to exits, emergency equipment and utility controls should never be blocked. All laboratory work areas

should be cleaned and counter wiped, glassware washed and put away, and students hands washed before the leaving the classroom.

With regards to laboratory chemical storage, the amounts permitted should be as small as practical. Chemical storage on bench tops is not allowed and storage in fume hoods should be very minimal. Chemical exposure to heat or direct sunlight should be avoided. Storerooms should be segregated into well identified areas that are adequately ventilated. Highly toxic chemicals or opened containers should be in unbreakable containers or in secondary containment.

Toxic substances should be segregated with regards to compatibility in a well-identified area with local exhaust ventilation. Highly toxic or other chemicals whose containers have been opened should be in unbreakable secondary containers. Stockrooms/storerooms should not be used for preparation or repackaging. When chemicals are hand carried, the container should be placed in an outside container/ bucket or carried with both hand while having one hand on the bottom of the container to laboratory stations.

Stored chemicals should be examined at minimum annually for replacement, deterioration and container integrity. Periodic inventories should be conducted with unneeded items going for appropriate disposal or return. Storerooms holding hazardous chemicals should be under the control of the Science Teacher or Chemical Hygiene/Safety Officer and secured from entry to students and other building occupants.

Ideally, one chemical/biological storage room under the supervision of a qualified person is advisable. The storage room should have adequate security. Safety features for the facility should include:

- Accessibility of approved fire extinguishers
- Working emergency shower or eye/face wash
- Forced ventilation from floor to ceiling with exhaust above roof level
- Impervious shelving with half-inch lip, secured to wall with the top shelf below eye level
- Explosion proof lighting and good illumination; and
- Spill Kit items and other clean-up materials.

<u>Storage Room “DO’S”:</u>

- Chemicals must be stored under lock and key when not in use
- Chemicals must be stored in adequately labeled containers
- Always store chemicals with labels in the forward, readable, position

- Chemicals that are transferred into a another container must include the following information on the label: chemical name, formula, concentration, hazard warning, name or initials of person responsible for transfer
- Flammable liquids and solids must be stored in a dedicated flammable storage cabinet
- Use of secondary containment to limit spills and avoid incompatibility problem
- Order chemicals in plastic containers or plastic-coated bottles to reduce breakage
- Plan your storage to survive a catastrophic event by limiting the potential for spills and breakage
- Return chemicals to their designated storage location promptly after use
- Store corrosives acids in a locked acid locker vented to the outside
- Isolate nitric acid within the acid storage cabinet by enclosing it in a high density polypropylene container because it not only is an acid but also an oxidizer
- Keep lab shelves organized and compatible chemicals together
- Do not permit unauthorized persons in the storage room; and
- Ensure hazardous waste or by-products are stored properly before disposal.

Before leaving, secure open chemical containers, close and lock the flammable lockers, close and lock the acid lockers, and secure the chemical storage room/areas.

<u>Store Room "DON'TS":</u>

- Chemical storage rooms and closets should not have open floor drains
- Never grab a container from the top only, chemical containers should be carried with two hands
- Don't use unlabeled chemicals
- Don't permanently store chemicals in the fume hood
- Don't store chemicals over, under or near a sink or drain
- Don't mix chemicals in a sink
- Don't store reagents and/or apparatus on the lab bench
- Don't store chemicals on the floor
- Don't block aisles with stored chemicals
- Don't store chemicals above eye level or on top of cabinets
- Don't dispose of broken glassware in trash with wrapping it
- Don't store hazardous waste in the student work areas
- Don't store chemicals alphabetically

Keep accurate records of the amount of all chemical product on hand; this inventory should be updated at least annually.

Regulations on chemical storage can be obtained from the Environmental Protection Agency (EPA), Uniform Fire Code (UFC), National Fire Protection Association (NFPA), Florida Fire Protection Agency (FFPA), and Occupational Health and Safety Administration (OSHA).

Signs and Labels

Signs and labels should be posted on:

- Exits
- Chemical storage areas
- Areas approved for food and beverage consumption only
- Location signs for eyewash stations, other safety and first aid kit
- Warnings for areas or equipment where specials or unusual hazards exist
- Labels identifying contents of containers, including waste receptacles; and
- Emergency telephone numbers of emergency responders and Chemical Hygiene Officer

Place signs conspicuously in the laboratory and on refrigerators to warn occupants that:

- No food or drink is permitted in the refrigerator
- No food or drink is permitted in the laboratory; and
- Hands must be washed before leaving the lab.

Original manufacturers' labels, by law, must be on all incoming chemicals under OSHA's Hazard Communication Standard. An MSDS must be promptly reviewed and readily available in hard copy for all hazardous chemicals in storage. Laboratory users must be provided a copy of all MSDSs within 15 days upon request. Stock solutions and reagents must be labeled with the name of the contents, their hazards, and the preparation date. Unlabeled container with unknown contents must be handled as hazardous waste. Disposal of unknown chemicals is very expensive.

Spills & Accidents

A spill control policy should be developed and include considerations for prevention, containment, cleanup and reporting for all releases and spills occurring in laboratories. The spill policy should include a one-page emergency plan to outline immediate response requirements. Proactive practice drill should be conducted so all students are familiar with the spill control and any accompanying emergency plan. There should be an alarm system to alert building occupants in all parts of the school. All accidents or near accidents should be reported so they can be analyzed so in the future so any

similar situation can be avoided. In the event of a spill or release, the emergency circumstances should be communicated immediately to all personnel in the surrounding area and Main Office. At that time, all spill procedures should be implemented with regards to: evacuation, ventilation requirements, medical care, spill response and reporting.

Be prepared for accidents. Assure that at least 2 people are present at all times when working with hazardous chemicals. Breakable containers should be stored in chemical resistant trays so in the event of a release the secondary containment can be placed under the fume hood. If a major spill occurs outside the hood, evacuate the area and assure that cleanup personnel wear appropriate protective equipment.

Standard ABC fire extinguishers should be readily accessible in strategic areas in the laboratories and near hallway entrances of the laboratory. A smoke detector should be installed, at minimum, in each chemical storage area. And it is recommended that a pail of sand be located in the laboratories for emergency use.

Chemical spills and leaks can occur in any laboratory. In order to minimize injury to health, property, and fire, Spill Kits must be on hand to deal for minor spills. Without risking personal safety, the clean up of a minor spill utilizing these kits is allowed if wearing appropriate protective clothing. However, any major spill will require professional remediation.

<u>If a spill of a hazardous chemical occurs:</u>

- Evacuate classroom immediately
- Affected skin or clothing should go immediately under eye wash/shower/drenching unit
- Avoid breathing the vapor if it is a liquid spill and turn on emergency exhaust
- Notify an administrator & Chemical Hygiene/Safety Officer as soon as possible regarding the incident
- Notify the health aide of any injuries
- Follow the MSDS's instructions for clean-up procedures
- Follow the general procedures for using the Spill Kit; and
- Deny access to the area until cleanup has been completed.

<u>Emergency Protocols, Laboratory Hazards & Emergency Actions</u>

- Spills must be remediated after the room has been evacuated and the area stabilized, however, the safety of staff and students takes precedence
- Know the correct evacuation routes
- Know the location of the master shut-offs for gas and electrical power

- Know what to do during a power outage
- Events causing material damage but not effecting students must be attended to immediately, however, the safety of staff and students takes precedence at all times; and
- Post emergency telephone numbers near all telephones.

Chemical Hygiene/Safety Officer

The Chemical Hygiene/Safety Officer should provide all science teachers with pertinent information to ensure that they are familiarized with the hazards of chemicals found in their laboratories and storage areas. Scientific literature should always be available. This information is to be provided before the initial work in the science laboratories begins or when working for the first time with a hazardous chemical. Any laboratory worker who works with hazardous chemicals in the laboratories are required to know the contents of this CHLSP and be familiar with the content of the OSHA 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."

All Chemical Hygiene/Safety Officer's and Science Teacher are required to be familiar with:

- permissible exposure limits (PELs) per OSHA for substances used in the labs

  (http://www.osha.gov/pls/**osha**web/owadisp.show_document?p_table=standards&p_id=9765).
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
- Location and availability of known reference material on hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory to include Material Safety Data Sheets received from chemicals suppliers or directly from the manufacturer.

Waste Disposal Program

The aim of a waste disposal program is to assure minimal harm to humans or the environment from the disposal of waste laboratory chemicals and their by-products left from curriculum experiments. The Division of Safety and Emergency Management dictates how waste is to be collected, segregated, stored and transported.

During the planning stage of a school experiment, assure that each laboratory operation includes training and waste disposal procedures. Deposit chemical waste in appropriately labeled containers. Do not discharge concentrated acids and bases or highly toxic substances into the sewer or any other substances that might: interfere with the biological activity of the local wastewater treatment plant; create a fire or explosion; or cause structural damage to the school building. Store contaminated waste in closed, suitably labeled, impervious containers. Unlabeled containers of chemicals and solutions should go for prompt laboratory review and disposal and if partially used they should not be reopened.

Most importantly, the MDCPS Division of Safety and Emergency Management (http://safety.dadeschools.net) should be contacted after the voluntary termination of a Science Teacher, so they can assure that the chemicals that the teacher was responsible for are inventoried, the storage room cleaned out, and all unwanted chemicals go for proper disposal. No new Science Teacher should accept the onerous of legacy wastes/unwanted chemicals that they did not order, were never responsible for, and are aged and unusable.

It is recommended that waste should be moved to a central storage location at least once per week or designated "Satellite Accumulate" sites should be set up. A Satellite Accumulate site allows for the accumulation of by-products that is generated on daily basis to be stored outside of the formal storage area and labeled with the Hazardous Waste label with the date the first waste is added to the container and after full, the date the container is placed into storage. Once the container is full, it must be place in storage within 3 days.

Indiscriminate disposal of laboratory chemicals by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable. Volatilizing chemicals in the fume hood, which is considered media-exchange, should not be used as a means of disposal. Disposal by recycling or chemical decontamination should be used when possible under an approved waste minimization program.

NO MERCURY **is allowed in any school at Miami-Dade County Public Schools.**

Disposal for unwanted or waste chemicals require the:

- Establishment of disposal procedures/mechanisms before chemicals are purchased
- Formulation of a comprehensive list of chemicals you wish to go for disposal
- Science Teacher to ensure laboratory chemicals are disposed of in compliance with the Resource Conservation and Recovery Act (RCRA) (http://www.epa.gov/epawaste/index.htm) state rules designed to minimize damage to human health and to the environment
- Reuse/recycle of chemicals whenever possible, before disposing/discarding of unwanted chemicals, contact other schools to determine if your overstocked items can be used at other locations
- Expired or obsolete chemicals go for disposal
- Disposal of chemicals instructions obtained from the manufacturer or licensed chemical contractor who professionally lab-pack laboratory waste for disposal—contact the MDCPS DSEM if your school is planning to dispose of any laboratory chemicals
- MSDS(s) with the chemical/s that have been declared a waste
- Classification of chemicals as a hazardous or non-hazardous

- Laboratory analyses of unlabeled bottles (a special problem), all mystery bottles will under go a battery of costly laboratory tests to determine the disposal method, so it is very important to label each chemical properly
- Fume hoods never used to evaporate a hazardous waste or chemical you want to discard
- Disregard of the "Flinn Scientific, Inc." catalog referenced disposal treatment methods since they are considered illegal in the State of Florida. The only disposal "treatment" permitted in the District is the neutralization of small quantities of acids and bases; and
- When in doubt concerning the disposal of unwanted or waste chemicals, contact the Division of Safety and Emergency Management Hazardous Waste Technician who will arrange for the disposal.

GENERAL PROCEDURES FOR WORKING WITH CHEMICALS

Basic Rules and Procedures for Working with Chemicals

The following OSHA rules and procedures are required by all MDCPS personnel and students in the event of an accident and spill:

- Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention
- Ingestion: Encourage the victim to drink large amounts of water and seek medical attention
- Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing, If symptoms persist after washing, seek medical attention
- Spill Clean-up: Promptly clean-up spills, using appropriate protective apparel and equipment and proper disposal

To avoid unnecessary exposure to chemicals involves the development and encouragement of safe laboratory practices:

- Do not smell or taste chemicals
- Vent any discharge of toxic chemicals into fume hood
- Avoid eating, smoking, gum chewing or application of makeup where laboratory chemicals present
- Avoid storage, handling and consumption of food or beverage in chemical storage areas, refrigerators, laboratory glassware and utensils
- Handle and store glassware with care to avoid damage
- Use equipment for designated purpose
- Wash hands copiously after working in the laboratory

- No horseplay in laboratory area that could distract, confuse or startle another lab worker
- Do not mouth suction pipette or start a siphon
- Confine long hair, loose clothing and wear shoes not sandals
- Keep work area clean and uncluttered
- Make sure chemical bottles and equipment is properly labeled and stored
- Clean up the work area at the end of each day
- Assure the appropriate eye protection is worn where chemicals are stored and handled
- Inspect gloves before use, wash them before removal and replace them periodically
- Inspect the respirator before use
- Use appropriate respiratory equipment when necessary
- Use any other protective and emergency equipment as appropriate
- Avoid use of contact lenses in the laboratory unless unavoidable
- Remove laboratory coat and aprons immediately if contaminated
- Seek information about hazards and plan procedures with regards to protection and equipment
- Unattended operations requires signs on the door and provisions for secondary containment
- Be alert to unsafe conditions and see that they are corrected; and
- Do not work alone if procedure being conducted is hazardous.

SAFETY RECOMMENDATIONS

According to OSHA the following is a list of major categories of safety hazards found in laboratories: Corrosive agents, electrically powered equipment, fires and explosions, low temperature procedures and pressurized/vacuum operations, which also include the use of compressed gas cylinders. The following general guidelines are requisites to be followed by laboratory workers and school staff members as outlined below.

Equipment Requirements for All Laboratory Workers:

- Regularly inspect emergency showers, eyewash fountains and fire blankets and retain the records
- Ensure that eyewash fountains and emergency showers will supply at least 15 minutes of water flow
- Keep all equipment in working order

- Do not block exits, aisles, or accesses to emergency equipment or controls
- Do not permit students to use broken or unsafe equipment
- Maintain a file of instruction/operating manuals for all science equipment
- All gas valves in the lab should be turned off at the end of the lab. The master gas valve, if one exists, must be turned off at the end of the day
- Check the stability of shelving that stores chemicals and glassware
- All rough glass edges should be fire polished using prescribed common science practice procedures
- Do not have students insert glass tubing. Teachers should do this procedure. When inserting glass tubing into a rubber stopper, lubricate the tubing with glycerin, wrap the tubing with a towel, and gently twist the tubing into the stopper hole
- Use a grease pencil for labeling glassware
- Place glass-ware contaminated with blood or other body fluids in a "Sharps Container," if available.
- A fume hood should be used for any activity which might result in the release of toxic vapors, mists, fumes, dust or known allergens, flammable gases and noxious odors. Fume hoods must be used when the risk of exceeding a PEL is present or for any chemical whose PEL is 50 ppm or less
- Never lean into the fume hood
- Place fire extinguishers near an escape route
- Compressed gas cylinders must be secured at all times
- Large gas cylinders should be chained to the wall
- All moving belts and pulleys should have safety guards; and
- Report missing/stolen materials or chemicals to the Principal immediately.

Science Teachers' Safe Work Practices:

- Unsafe conditions, inoperable or damaged safety equipment or any other potential hazards in the classroom or storeroom should be reported in writing to the school administrator so that a work order can be submitted
- Never perform a first-time chemical demonstration in front of your class. Explain and perform a first-time demonstration in front of other science teachers and have them evaluate the need for specific safety precautions to implement before conducting the experiment in front of students
- Science laboratories should be used for science classes only
- Lab entrances should always be locked when not in use
- Involve students in the pre-lab phase to plan actions in case of an accident

- Warn students of all anticipated hazards.
- Provide verbal and written safety instructions to students
- Document students' understanding of proper safety practices prior to each lab activity
- Document in your lesson plans safety measures you take as a part of your teaching
- Never work alone in a science laboratory or storage area
- Never allow students to be left unsupervised
- Report accidents to an administrator; document the incident in writing
- Accidents should be analyzed to prevent repeat incidents
- Never overlook any infraction of a safety procedure
- Establish clear safety rules based on safety standards and anticipated events
- Consider individual student differences in maintaining safety
- Be aware of current safety research and regulations
- Use proper procedure when an accident or injury occurs
- Do not permit horseplay in the lab--Maintain Control!
- Group sizes should conform to a number which can perform the experiment safely
- Plan enough time for the experiment and clean up
- Instruct students never to eat or drink in the classroom
- All students performing scientific experiments must wear the appropriate required PPE
- Visitors to the classroom must follow safety rules
- Hand protection should be worn when picking up broken glass. Small pieces should be swept up with a brush and dust pan
- Allow falling objects to fall; never try to grab a falling object
- Allow glassware to cool after heating by placing it on a special heat-transfer surface.
- Do not submerge hot glassware in water
- Always pour acid into water--never water into acid
- Never pipette with your mouth, use a pipette bulb or automatic filler
- Before using an open flame remove all flammable substances from the immediate area. Do not use an open flame to heat a flammable liquid or pressurized distillation. Restrict use of an open flame and extinguish it as soon as it is no longer needed

- Develop a written plan of action for emergencies to secure the lab. In a fire drill event, make sure equipment, including heat sources, are turned off
- Include a list of safety rules with a substitute's lesson plan, however, it is advisable that a substitute not conduct a lab activity
- Document safety violations and report safety concerns in writing to your Principal
- Post emergency telephone numbers in a conspicuous location in the science room
- Do not permit students to take science materials home
- Teach and practice safety precautions when working with electrical current
- Be aware of students' medical predispositions that could be compromised in lab situations (e.g., epilepsy, allergic reactions, pregnancy, etcetera); and
- Collaborate with other science colleagues when reviewing and updating lab activities to current safety standards.
- Always inform co-workers of plans to carry out hazardous work
- Establish a specific safety plan for each building.

A key feature in creating a safe laboratory environment is a school science curriculum that has well-planned laboratory experiences. To create a safe laboratory environment requires: planning, instruction, and a certain amount of troubleshooting. Planning refers to the teacher having done the lab activity previously to familiarize himself/herself with the procedures and how long it will take. It also includes outlining safety procedures for a given activity and documenting these safety considerations in each lesson plan. Planning can refer to the teacher taking steps to insure student knowledge and accountability for safety practices.

Instruction refers to concise and easily understood written and verbal instructions for a lab activity, as well as materials being prepared and measured ahead of time. It includes equipment being procured and checks to assure all equipment operational and safe. Troubleshooting refers to identifying all the possible hazards of an activity and taking steps to minimize the dangers. If the potential hazards outweigh the educational value, the activity should be omitted.

<u>Lesson Plans</u>

In the classroom, Science Teacher's are required to incorporate health and safety as an integral part of their instruction. Ultimately, it is the teacher's responsibility to make certain that proper safety considerations have been made and that the appropriate precautions have been taken. These safety features should be reflected in the documented Lesson Plans. Teachers should ask themselves the following questions before conducting every laboratory experiment:

- What are the risks associated with this activity?
- What are its worst possible outcomes?

- What do I need to do to be prepared if these outcomes should occur?
- What practices, equipment and facilities would reduce risks?
- How can I relate these hazards to dangers that my students face in their everyday lives?

Recommendations for Physics, Physical Science, and Earth/Space Science Teachers:
In general, laboratory experimentation in physics, physical science, and Earth science pose fewer hazards to students because of the limited exposure to chemical reagents and to living things. However, there are some hazards unique to these courses related to electricity, light, heat, and chemicals.

Experiments with Electricity:

- Instructor must be aware where the electrical shut-off switch is located and know how to use it.
- Instructor must check that all students are capable of working with electrical equipment and will not interfere with any medical condition or devices (e.g., pace makers).
- Instructor must check all circuits before applying power.
- Hands and feet must be dry when working with electrical circuits or electrical equipment.
- Laboratory floor must be dry when working with electrical equipment.
- Power should be off before making electrical connections.
- Capacitors should be discharged before handling.
- Power supplies must be properly grounded.
- Both hands should not contact a circuit. Use electricians rule: keep one hand in a pocket while making electrical adjustments with the other hand.
- Caution should be taken when demonstrating static electricity with the Van der Graff Generator. Do not allow students to crowd apparatus. An accidental discharge may cause an involuntary reaction that may injure students standing nearby.
- Students should be cautioned that even common 110 V household current can be lethal.

Experiments with Light:

- Students must never look directly at the Sun under any circumstance.
- When making observations through a spectroscope, telescope, or pinhole camera, students should use indirect or projection methods.

- Appropriate ultraviolet protective safety goggles should be worn if black light or ultraviolet radiation experiments are performed.
- Glass lenses, mirrors, and prisms should be inspected for chips, cracks, or sharp edges.
- Instructors must be aware that strobe lights can trigger seizures in some people and should be prepared in the event that a student experiences such medical condition.
- Gas discharge tubes can emit very energetic light when excited by Tesla coils or by standard power supplies. **Avoid tubes that emit X-ray or ultraviolet light**.
- When using lasers, follow the safety instructions accompanied with the laser. **Never allow the laser beam to be directed into eyes**.

Experiments with Heat:

- Experiments with resistive heating may cause high temperatures. Caution must be taken to avoid burns.
- Students with long hair must tie it back whenever working with any open flame.
- When working with regular or incandescent lamps, caution should be exercised due to the heat generated by the lamps as they may cause burns.
- Mercury thermometers must be replaced by alcohol thermometers. In the event that a mercury spill occurs contact MDCPS DSEM (http://safety.dadeschools.net) for clean up procedures.

Experiments with Model Rockets:
The use of model rockets requires the consideration of safety in several areas: construction, engines, launch, flying conditions, and recovery. For more information visit the National Association of Rocketry - http://www.nar.org/ .

- Use the proper glue when constructing the rocket. Do not allow students to inhale vapors from the glue.
- Follow safety warnings provided in the rocket equipment and materials.
- Test rocket for stability before launching (e.g., swing test).
- Use factory made rocket engines as recommended by the manufacturer.
- To destroy a bad engine soak it in water until it falls apart.
- Flying conditions must be considered to avoid launches that may be dangerous to people or property. Do not launch in high winds, near buildings, power lines, tall trees, or low-flying aircraft.
- All people involved in the construction and launching of model rockets must be familiar with the appropriate safety rules http://www.nar.org/safety.html .

LABELS & MATERIAL SAFETY DATA SHEET(MSDS)

A Material Safety Data Sheet (MSDS) is a document that contains comprehensive information regarding the physical and chemicals characteristics of the substance and is prepared by the manufacturer and/or supplier. MSDSs contain hazard evaluations on

the use, storage, handling, and emergency procedures all related to that material. The MSDS is designed to contain more complete information about the material than the label. Every MSDS is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if an accident occurs, how to recognize symptoms of overexposure, and what to do if such incidents occur.

With respect to labels and Material Safety Data Sheets, the Chemical Hygiene/Safety Officer or lead Science Teacher is responsible to:

- Require labels on all containers of hazardous chemicals
- Maintain MSDS's received with incoming shipments of hazardous chemicals; and
- Ensure all MSDS's are readily accessible to laboratory workers.

It is the ***responsibility of the Science Teacher*** to know what substances are used in every school experiment, to review the MSDS for each substance, and to provide the MSDS to their students for review before students work with those chemicals.

It is the ***responsibility of the students*** to read and understand the MSDSs for every chemical before using them during a lab activity.

All Material Safety Data Sheets must be available in each chemistry laboratory classroom. The MSDSs can be sorted by lab exercises, so all of the MSDSs for materials used in that particular lab can be grouped together.

APPENDIX A

Laboratory Safety Rules and Contract

Rules:

- Know the primary and secondary exit routes from the classroom.
- Know the location of and how to use the safety equipment in the classroom.
- Work at your assigned seat unless obtaining equipment and chemicals.
- Do not handle equipment or chemicals without the teacher's permission.
- Follow laboratory procedures as explained and do not perform unauthorized experiments.
- Work as quietly as possible and cooperate with your lab partner.
- Wear appropriate clothing, proper footwear, and eye protection.
- Long hair should be tight in the back.
- Report all accidents and possible hazards to the teachers.
- Remove all unnecessary materials from the work area and completely clean up the work area after the experiment.
- Always make safety your first consideration in the laboratory.

Safety Contract:

I will:

- Follow all instructions given by the teacher.
- Protect eyes, face and hands, and body while conducting class activities.
- Carry out good housekeeping practices.
- Know where to get help fast.
- Know the location of the first aid and fire fighting equipment.
- Conduct myself in a responsible manner at all times in a laboratory situation.

I, _____, have read and agree to abide by the safety regulations as set forth above and any additional printed instructions provided by the teacher. I further agree to follow all other written and verbal instructions given in class.

Student Signature: _____Date: _____

Parent Signature: _____Date: _____

APPENDIX B

Acronyms

ANSI	American National Standard Institute
CHLSP	Chemical Hygiene and Laboratory Safety Program (This document)
CHP	Chemical Hygiene Plan
EPA	Environmental Protection Agency
FFPA	Florida Fire Protection Agency
MDCPS	Miami-Dade County Public Schools
MDCPS DSEM	Miami-Dade County Public Schools Division of Safety and Emergency Management 12525 NW 28 Avenue Miami, FL 33167 305-995-4900 | 305-995-4924
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PPE	Personal Protection Equipment
PELs	Permissible Exposure Limits
TLVs	Threshold Limit Values
UFC	Uniform Fire Code